How Safe Is Your Safelight?
A GUIDE TO DARKROOM ILLUMINATON

IMPORTANT FACTS ABOUT SAFELIGHTS

➤ **No safelight provides completely safe exposure for an indefinite period of time.**

➤ **Safelight filters are designed for specific types of paper and film.**

➤ **Safelight filters fade with use.**

➤ **Poor safelight conditions can produce a loss in photographic quality before actual fogging is visible.**

➤ **Many photographic materials require handling in TOTAL darkness.**

Therefore, you should

• Follow all safelight recommendations for your paper or film. See product instructions for recommended safelight filter, bulb wattage, and minimum safelight distance.

• Test your safelight conditions regularly.

• Replace your safelight filters when necessary.

In photography, the term "safelight" describes darkroom illumination that does not cause a visible change to light-sensitive material when it is correctly handled and processed. The word "safe" is relative. Most sensitized materials will be affected if you expose them to safelight illumination for an extended period of time. Because photographic materials vary in speed and sensitivity to different colors of light, the recommended bulb wattages and colors of safelight filters also vary. Safelight illumination will fog color films and papers; color print and transparency materials; most panchromatic black-and-white films (films that are sensitive to blue, green, and red light); and high-speed infrared films. You must handle these materials in total darkness.

Ideally, safelight filters should transmit only light that is outside the color-sensitivity (wavelength) range of the photographic materials they're recommended for. Safelight filters recommended by Kodak provide maximum transmission of those colors that the paper or film emulsion has relatively low sensitivity to. However, the color sensitivity of most emulsions does not end abruptly at a particular wavelength in the spectrum—most emulsions are somewhat sensitive to colors outside the intended range. This means that most papers and films have some sensitivity even to the colors of light transmitted by the recommended safelight filters. *Therefore, always minimize the exposure of photographic materials to safelight illumination.*

A safelight has three basic parts:

1. The lamp housing. This holds the bulb and the filter, and keeps the white light emitted by the bulb from escaping.

2. The safelight filter. This absorbs light of some colors and transmits light of others to varying degrees.

3. The bulb. The recommended wattage is determined by the sensitivity of a particular material, the transmission characteristics of the filter, the type of illumination the lamp housing provides — spot (direct) vs general (indirect) — and the distance between the safelight and the area where you handle the material.

"KODAK Safelight Lamps" on page 7 contains descriptions of a number of KODAK Safelight Lamps and appropriate uses for the different types. The table on page 3 lists typical sensitized products and the safelight filters recommended for use with them. The table also shows the bulb-wattage recommendation for each application. See the paper or film package for safelight recommendations for specific materials. **Be sure to follow the recommendations for both the wattage of the bulb and the minimum distance between the lamp and the photographic material.**

The "safest" color safelight filter for a particular material is not always the recommended one. For example, a red safelight filter often has less effect on photographic papers than the amber filter listed in the table. However, most workers find that they can judge print density or perform other functions better under an amber light. (So, although it is a slight compromise in protecting the paper from fogging, an amber filter improves working conditions.)

The apparent color of a safelight filter is only a partial indication of its transmission characteristics. Colored bulbs or other improvised safelights may appear to be the right color, but they may actually emit light (or other forms of radiant energy) that will fog a photographic emulsion. KODAK Safelight Filters are made to precise light-transmission and absorption standards that relate to the spectral sensitivities of photographic materials.

Safelight filters gradually fade with use. This means that they transmit more and more light of the colors that they absorb when they are new. You should plan to periodically change safelight filters. For example, if you use safelight lamps for 8 to 12 hours a day, you may need to change the filters every three months.

Bulbs eventually blacken and produce less light. To keep the illumination level consistent, periodically change bulbs. Noting the replacement dates on a sticker on the safelight housing will help you keep track of bulb and filter changes. We recommend that you change bulbs before running safelight tests.

TOTAL-DARKNESS MATERIALS

Because of their sensitivity to light of all colors, you must handle the following types of films, plates, papers, and materials *in total darkness:*

- Panchromatic black-and-white films and plates
- Color camera films
- Slide and print films (for making transparencies from color negatives)
- Duplicating and internegative films
- High-speed infrared films
- Color reversal papers
- Color negative papers and materials designed for Process RA-4

SAFELIGHT RECOMMENDATIONS

KODAK Safelight Filters are available in sizes to fit the KODAK Safelight Lamps shown on page 7. Their transmission characteristics make them suitable for use with a number of photographic materials (see the table on page 3).

Blue-Sensitive and Orthochromatic Black-and-White Films. You can handle these types of films under red safelights. The spectral sensitivity and the speed of the particular film determine the safelight filter that you need. See the table on page 3.

Black-and-White Papers. Black-and-White papers are developed in processors or by inspection trays. Safelight illumination is generally brighter near the trays than it is anywhere else in the darkroom. Be sure that this illumination is safe for the total development time. Excessive exposure to proper safelight illumination, or normal exposure to unsafe illumination, will degrade the highlights and lower print contrast. This occurs before actual fogging is visible in areas that receive no white-light exposure, such as print borders. As a result, a questionable safelight condition might not be detected for some time. (See the "Test for Black-and-White Papers" on page 5.)

Safelight exposure can occur before **and** after the printing exposure. A low-level overall exposure either before or after the printing exposure is technically referred to as a "super-additive exposure." "Safe time" for safelight exposure is defined as any exposure time less than or equal to one-half the time required for a safelight to produce a detectable change in a particular sensitized product. Virtually all exposures are cumulative and can cause contrast and density changes. The tests on pages 5 and 6 will help you determine a safe time for your application.

Panchromatic papers are more sensitive to the safelight illumination normally used with black-and-white papers. To help protect these papers against image-quality change and safelight fog, use them with special filters or small-wattage bulbs (see the table on page 3). Safelight specifications are printed on the package. Recommendations for safelight filters for specific Kodak photographic materials are based on test procedures similar to those described in ANSI Standard PH2.22-1998.

Color Materials. Handle color camera films, duplicating films, internegative films, slide and print films (for making transparencies from color negatives), and KODAK PROFESSIONAL and KODAK EKTACHROME Papers and Materials (for making prints directly from slides and tranparencies) in **total darkness**.

Also handle papers and materials for Process RA-4 in **total darkness**. These materials include KODAK PROFESSIONAL Papers and KODAK EKTACOLOR Papers, as well as KODAK PROFESSIONAL DURAFLEX Print Material, KODAK PROFESSIONAL DURATRANS Display Material, and KODAK PROFESSIONAL DURACLEAR Display Material.

However, **if absolutely necessary**, you can use a safelight equipped with a KODAK 13 Safelight Filter (amber) and a $7\frac{1}{2}$-watt bulb. Keep the safelight at least 4 feet (1.2 metres) from the paper. Run test to determine that safelight use gives acceptable results for your application. Using a safelight **will** affect your results.

Safelight Recommendations

KODAK Safelight Filter	Color	For Use with KODAK Material*	Frosted Bulb	
			Direct Illumination (no closer than 4 ft [1.2 m])	Indirect Illumination†
OA	Greenish yellow	Black-and-white contact and duplicating materials. Projection films.	15-watt	25-watt
OC	Light amber	Contact and enlarging papers.	15-watt	25-watt
OO	Light yellow	Graphic arts halftone films (for flashing halftones made through a contact screen for contrast control).	6- or $7\frac{1}{2}$-watt at 6 ft (1.8m)	Not Applicable
1	Red	Some blue-sensitive materials, some KODAK PROFESSIONAL LINAGRAPH Papers, most phototypesetting materials, KODAGRAPH Projection Films.	15-watt	25-watt
1A	Light red	Slow orthochromatic materials, KODALITH and KODAK PROFESSIONAL KODAGRAPH Orthochromatic Materials. High-resolution plates.	15-watt	25-watt
2	Dark red	Fast orthochromatic materials. Orthochromatic LINAGRAPH Papers. Some green-sensitive x-ray films, KODAK PROFESSIONAL EKTALINE Films.	15-watt	25-watt
6B	Brown	KODAK PROFESSIONAL INDUSTREX Films and Papers and other blue-sensitive x-ray films.	15-watt	25-watt
7B	Green	Infrared laser films.	$7\frac{1}{2}$-watt	Not Applicable
8	Dark yellow	EASTMAN Color Print and Intermediate Films.	15-watt	25-watt
10	Dark amber	KODAK VERICOLOR Slide Film, KODAK VERICOLOR Print Film, KODAK PANALURE Papers.‡	15-watt	25-watt
11	Opaque in appearance; transmits infrared radiation	Conventional sensitized products when viewed with infrared inspection devices. **Do not** use with infrared-sensitive materials.	15-watt	Not Applicable
13	Amber	KODAK PANALURE, KODAK EKTACOLOR, KODAK PROFESSIONAL, and panchromatic black-and-white papers.	$7\frac{1}{2}$-watt	15-watt
GBX-2	Red	Most blue- and most green-sensitive medical and dental x-ray films.	15-watt	25-watt

* See the instructions packaged with the product for specific information on exposure to safelight illumination.
† Data in this column refer *only* to use of the KODAK Utility Safelight Lamp, Model D.
‡ Requires reduced bulb wattage.

PLACEMENT OF SAFELIGHT LAMPS

In black-and-white printing rooms and other areas where general safelighting is acceptable, position ceiling safelights so that the illumination is evenly distributed over the entire area. You can then place individual lamps where you need them most—at the processing sink, for instance. Do not place direct illumination closer than 4 feet (1.2 metres) from the work surfaces. Also avoid situations where pools of relatively bright light appear against a dark, unilluminated background. These conditions are difficult to work in and can be fatiguing to workers' eyes.

Consider safelight illumination before you paint a darkroom. Paint ceilings flat white for use with indirect safelights. The walls should be a light color—preferably a color similar to that transmitted by the safelight filters. A neutral color, such as light tan or buff, is suitable in most cases. Paint the wall area immediately behind each enlarger a flat black to avoid reflection of white light from the enlarger onto the paper. Flat black paint is also recommended around light locks to prevent unwanted light from entering darkrooms. An all-black darkroom is best for preventing fog or superadditive exposure in some applications, such as copying and duplicating.

KODAK Utility Safelight Lamps (see page 7) provide good indirect illumination when they are hung with the filter side facing the ceiling. In large rooms with white ceilings, place no more than one lamp for every 64 square feet (6 square meters) of ceiling area. For the work areas where you need more concentrated light, hang KODAK Darkroom Lamps from the ceiling, or use KODAK Adjustable Safelight Lamps with ceiling, wall, or shelf mountings. You can use a number of these lamps (with the correct filter and bulb) if they are at the proper distance from the photographic material and are spaced at least 8 feet (2.5 metres) apart.

Don't put a direct safelight where it will shine on an enlarging easel and make dodging and cropping difficult. Improperly placed safelights can also interfere with exposure calculators, and will decrease the safe time during which you can safely handle the paper in this location.

If your operation is large and you have a number of darkrooms for the same application, be sure that the safelight illumination is uniform from room to room. Similar wall paint and spacing of the safelights will provide uniformity. Operators can then work in any of the rooms under the same lighting conditions, and their judgement of quality under similar safelight conditions should remain consistent.

SAFELIGHT PRECAUTIONS

Many factors can cause unsafe illumination: an incorrect safelight filter, a faded or cracked filter, incorrect bulb wattage (too high), safelight location, or too many safelights. You can also experience light fogging from other sources; such as light escaping from an enlarger head, lighted dials on equipment controls, or non-opaque darkroom construction materials. For example, pinholes between the darkroom space and lighted areas can admit visible light, or plywood that appears opaque may admit infrared illumination. Even when you use the correct safelight filter and bulb, and observe the recommended safelight distance for the product, you should still test your darkroom conditions to be certain they are safe for the length of time that the photographic material will be under the safelight. Use the safelight tests described in "Test for Black-and-White Papers" on page 5, and the "Tests for Other Photographic Materials" on page 6 to determine a safe time for your darkroom conditions, and limit your safelight exposure to that time.

Excessive exposure to safelight illumination may show up only in the image area of your print, because that area receives additional exposure from the enlarger. This means that you may not recognize a change in image quality caused by excessive safelight exposure unless you perform a safelight test.

Note: Safelight tests that involve partially covering a piece of photographic material with an opaque object (such as a coin) and then exposing the material to safelight illumination can be misleading. They test only for fog—not for the added effects of safelight and enlarger exposures.

Always keep safelight exposure to a minimum. Store paper in lighttight containers, and make a habit of handling paper with the emulsion side down (away from the safelights). Place your enlarger so that the easel area receives very little safelight illumination. When you develop prints, insert the paper into the developer with the emulsion side down; turn the paper emulsion side up when experience tells you that the image has become visible. Let the results of your safelight test and your own practical experience guide you in determining how much time you have in handling photographic materials.

TESTING YOUR SAFELIGHT CONDITIONS

Test for Black-and-White Papers

Before starting the test—

- Install a new bulb in each safelight housing, and verify that you've selected the correct wattage for the paper you are using.

- Inspect your darkroom for light leaks. Turn off the white lights. If the room light is provided by fluorescent tubes, wait at least 5 minutes for the residual glow to dissipate. Then check to be sure that no white light is entering the darkroom through doorways, passthroughs, etc. (Remember, it takes at least 10 minutes for your eyes to become fully adjusted to the dark.)

- Correct any light leaks. Make sure that no white light is escaping from the enlarger or safelight housings.

After you have prepared the darkroom, test your safelight conditions by following the steps below:

1. Set up the enlarger. Insert the negative carrier with no negative in it into the enlarger. Set up the easel with a mask to expose an area as shown in Figure 1, below.

2. Turn the white lights off and turn the safelights on. Determine which paper-handling area receives the brightest illumination. This will usually be the area where you process prints.

3. Turn the safelights off, and run a test to determine what *enlarger* exposure is required to produce a light gray tone on the photographic paper with standard processing. You will probably have to set the lens to its smallest aperture and use a very short exposure time. Place a sheet of the photographic paper under the mask on the easel, and expose it. Process it in total darkness. Compare the unexposed area to the exposed area. The gray tone should have a reflection density of 0.25 to 0.50 (0.15 to 0.40 above the paper density) as measured with a reflection densitometer. Or you can make a visual comparison of the exposed area with the gray-scale

steps in KODAK Publication No. Q-16, *KODAK 24-Step Reflection Density Guide.*

4. Make the first enlarger exposure. *All* the lights should be off. For orientation, cut a corner from a fresh sheet of the photographic paper, and position the paper under the mask (see Figure 1). Expose the paper, using the time and aperture you determined in step 3. Label this area "After" to indicate safelight exposure that occurs *after* the enlarger exposure.

5. Make the safelight exposures. With all the lights still off, place a large piece of cardboard on top of the developer tray or in the area where safelight illumination is brightest. Place the photographic paper on the cardboard. Using an opaque card, cover about one fourth of the paper. Turn on the safelight, and expose the uncovered part of the paper for 1 minute. Move the card to cover half of the paper, and expose the other half for an additional 2 minutes. Cover all but one fourth and expose it for 4 more minutes. The four parts of the paper will have received 0, 1, 3, and 7 minutes of safelight exposure. (See Figure 2.)

6. Make the second enlarger exposure. With the paper oriented as in step 4 (Figure 1), position the marks to expose the opposite side of the paper. Give this area an exposure identical to the one given in step 4. Label this area "Before" to indicate safelight exposure that occurs before the enlarger exposure. (See Figure 3.)

7. Process the paper in total darkness.

8. Evaluate the test. The illustrations labeled "Test A," "Test B," and "Test C" on the next page show three possible results.

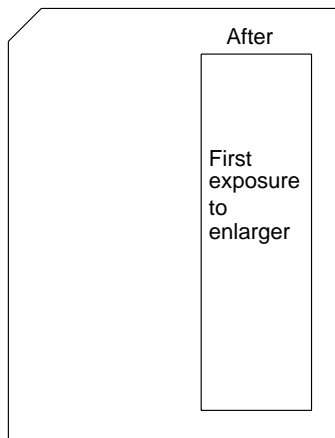## Safelight Test Procedure for Black-and-White Papers
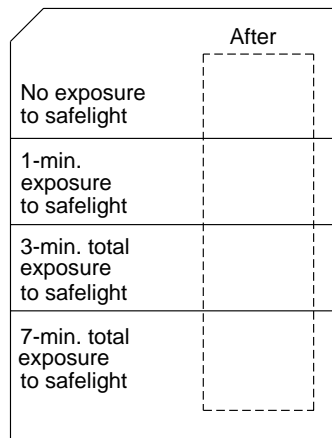

Figure 1
First Enlarger Exposure
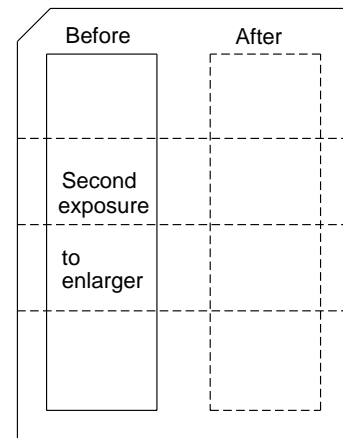
Figure 2
Safelight Exposure

Figure 3
Second Enlarger Exposure

Test A shows no added density on either side of the paper as a result of safelight exposure. This condition represents a safe time of at least 7 minutes.

Test B shows a potentially unsafe condition. The part of the paper that received a 7-minute exposure to the safelight alone is fogged. (Compare the density shown in the bottom fourth of the paper to the center and the borders of the rest of the paper.) The paper also shows signs of image change starting at 1 minute in the "Before" area, and at 3 minutes in the "After" area. This means that you must handle the paper very carefully before and after the enlarger exposure. If your safelight filter is old, results like these could indicate filter fading; replacing the filter should give you a longer safe time. If the filter is new, you can extend the safe time by using a lower-wattage bulb; moving the safelight lamp to a greater distance; using only dim, indirect safelighting for handling; or developing the paper for half the total time with the safelight off. Of course, you could avoid the risk of fogging if you develop the paper without any safelight illumination, or adhere strictly to the safe time indicated by the test.

A more typical result is shown in Test C. The paper is safe for up to 7 minutes of safelight exposure before the enlarger exposure, and up to 3 minutes of safelight exposure after the enlarger exposure. The test indicates that conditions are safe if you limit the total safelight exposure time to 3 minutes.

Some products are more sensitive to one sequence of exposures than to another. You can compare products by using this test or variations of it.

Tests for Other Photographic Materials

Blue-sensitive and orthochromatic sheet films are sometimes loaded into holders and processed in trays under safelights. You can devise a test for determining a safe time for these materials that is similar to the "Test for Black-and-White Papers." However, instead of exposing the film with an enlarger to provide the gray-tone exposure, expose the film in a camera.

Make a test object by mounting a KODAK Gray Card (KODAK Publication No. R-27) vertically on a jet-black, non-reflective background. Take a meter reading of the test object (including the black borders around the gray card). Then set the camera aperture and shutter speed to give about 1 stop less exposure than the meter indicates. You are now ready to expose two separate sheets of film.

Load two sheets of film into a film holder in total darkness. Make a camera exposure of the test object with the first sheet of film. Label this film "After" because safelight exposure will occur *after* camera exposure. Next, expose sections of the sheet of film to the safelight where you **process** the film. This is similar to the test for paper, except that you should try a total of 0, 4, 7, and 13 minutes, respectively. One quarter of the sheet receives no exposure. The next quarter receives 4 minutes. A third quarter receives 7 minutes (4 minutes + 3 minutes). The last quarter receives 13 minutes (4 minutes + 3 minutes + 6 minutes).

Then take the second sheet of film and expose sections of it to the safelight where you **load** film into holders. Use the same safelight exposure times that you used for the first sheet. Then make a camera exposure of the test object, using the same aperture and shutter speed as for the first sheet of film. Label it "Before."

Process both sheets of film in total darkness. After normal processing, a continuous-tone film should have a transmission density of approximately 0.4 in the gray-card area. The black border surrounding the gray card should not differ appreciably in density form the gross fog level of the film.[*] If the density of the gray-card area exceeds 0.4, or the density of the black border is much greater than the gross fog level, safelight fog may have occurred. You can evaluate your results by comparing them to the conditions described in step 8 under "Test for Black-and-White Papers."

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[*] The transmission density of a completely unexposed and normally processed sample of the film.

Evaluation of Safelight Test for Black-and-White Papers

Test A
Safe Condition

Test B
Unsafe Condition

Test C
Typical Condition
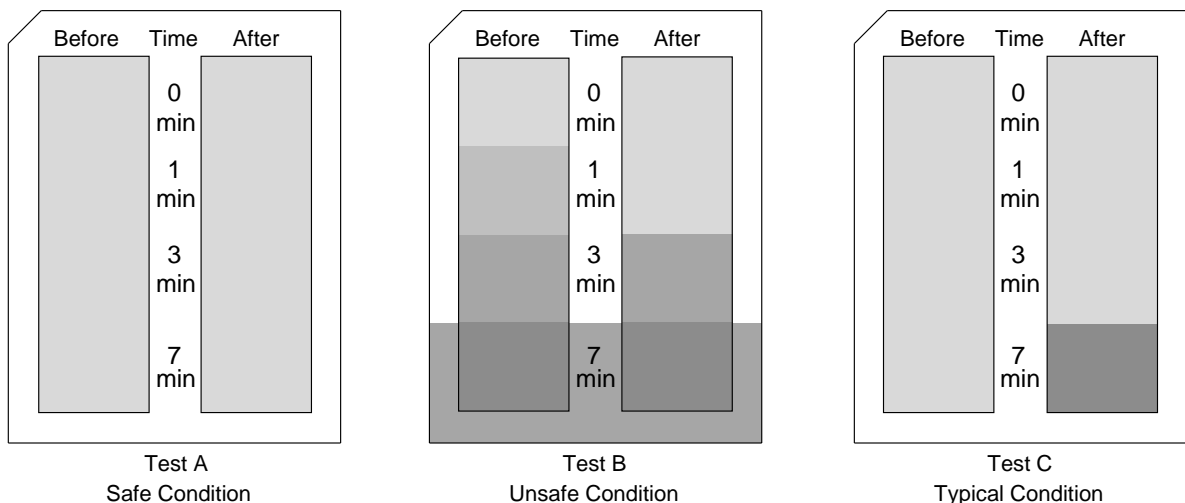
You can also adapt this test for use with papers in rolls. Roll papers that are printed in automatic or semiautomatic printers are susceptible to safelight exposure when you load and unload the printer, and when you load the paper into a processor. Adapt the safelight test to these operations by carefully studying your paper-handling procedures.

KODAK SAFELIGHT LAMPS

Kodak makes several types of safelight lamps to suit various applications, as described below. General darkroom illumination comes from ceiling safelights, such as the KODAK Utility Safelight Lamp, Model D. Local darkroom illumination is provided by safelight lamps that you can mount on a wall or underneath a shelf, or screw into a standard light-bulb socket. A single safelight lamp should be all that you need to illuminate a particular work spot, such as the processing sink.

If you handle materials that have different safelight requirements in your darkroom (e.g., conventional black-and-white papers and panchromatic black-and-white papers), all you need to do is change the safelight filters to suit the materials. Changing filters in local safelights is fairly easy because they are normally positioned at a convenient height. Changing filters in ceiling safelights may be a nuisance or cause delays in production. You might find it more convenient to have two sets of safelights wired to separate switches so that you can quickly change from one type of illumination to another.

Note: Avoid placing white-light switches where they might be mistaken for safelight switches.

KODAK Darkroom Lamp (CAT No. 152 1178). This safelight lamp screws into a standard light-bulb socket to provide direct illumination over sinks and benches. It accepts a $5\frac{1}{2}$-inch circular filter. As a rule, a 15-watt bulb is used in this lamp, but you should use only a $7\frac{1}{2}$-watt bulb with some materials. The exceptions are listed in the "Safelight Recommendations" table.

KODAK Utility Safelight Lamp, Model D (CAT No. 141 2261). This lamp hangs from chains attached to the ceiling and can give either direct or indirect illumination. It uses a 10 x 12-inch filter and a $7\frac{1}{2}$-, 15-, or 25-watt bulb. A bracket (CAT No. 152 1194) is also available for mounting the lamp on a wall or bench.

KODAK Adjustable Safelight Lamp, Model B (CAT No. 141 2212). Similar in design and purpose to the KODAK Darkroom Lamp, this safelight can be mounted on a wall or beneath a shelf with the bracket and screws provided with it. The lamp holds a $5\frac{1}{2}$-inch circular filter and either a $7\frac{1}{2}$- or a 15-watt bulb, and has a double-swivel shank.

How Safe Is Your Safelight?

A last reminder. No safelight is completely safe for an indefinite time. Do not leave exposed or unexposed paper under safelight illumination any longer than necessary. Use paper safes or lighttight drawers in the enlarger benches to store sensitized materials.

MORE INFORMATION

Kodak has many publications to assist you with information on Kodak products, equipment, and materials.

The following publications are available from The Tiffen Company at **www.tiffen.com**.

Q-16   *KODAK 24-Step Reflection Density Guide*
R-27   *KODAK Gray Card*

The *KODAK 24-Step Reflection Density Guide* is available from the Kodak Professional Accessories catalog, and the *KODAK Gray Card* is available through Silver Pixel Press, a Tiffen Company.

These publication are also available from dealers who sell Kodak and Tiffen products, or you can contact Tiffen in your country for more information.